2. Model the material removal rate for AJM process, where the material should be definedby user (ductile or brittle).

a. Inputs: Variable process parameters should be asked by the program during Execution

b. Inputs: Fixed process parameters & material properties should be fed to the Program using .txt/ .xlsx/ similar file format

c. Options for material: ductile or brittle – option should be fed by user during Execution of the program (corresponding loop will be there in the program)

d. Need to plot the MRR by changing the values of at least one input variable (for both, ductile & brittle material)

Solution:

```
clc; clear; close all;
t=readtable("ajm.xlsx");
p=t.p;
r=t.r;

% Input material type
material = input("Enter material type (ductile/brittle): ", 's');

% Input 1D arrays for velocity and mass flow rate
V = input("Enter set of velocities [ ] in m/s: ");
ma = input("Enter set of mass flow rates [ ] in gm/s: ");

% Convert mass flow rate from gm/s to kg/s
ma = ma / 1000;
p=p*10^6;
% Initialize MRR array
mrr = zeros(length(V), length(ma));

% Compute MRR based on material type
if strcmp(material, "ductile")
    for i = 1:length(ma)
        mrr(:, i) = (V.^2 .* ma(i)) ./ (2 * p(1,1));  % Element-wise calculation
    end
elseif strcmp(material, "brittle")
    for i = 1:length(ma)
        mrr(:, i) = ((4 / (6^1.5)) * (V.^1.5 .* ma(i))) ./ (p(2,1)^0.75 *
r(2,1)^0.25);
    end
else
    disp("Invalid material type! Please enter 'ductile' or 'brittle'.");
    return;
end
% % Compute MRR using Nested Loops
% % if strcmp(material, "ductile")
% if material=="ductile";
%     for i = 1:length(V)  % Loop over velocities
%         for j = 1:length(ma)  % Loop over mass flow rates
%             mrr(i, j) = (V(i)^2 * ma(j)) / (2 * p(1,1));  % Ductile material formula
%         end
%     end
% % elseif strcmp(material, "brittle")
% elseif material=="brittle";
```

```
%     for i = 1:length(V)
%         for j = 1:length(ma)
%             mrr(i, j) = ((4 / (6^1.5)) * (V(i)^1.5 * ma(j))) / (p(2,1)^0.75 * r(2,1)^0.25);
%         end
%     end
% else
%     disp("Invalid material type! Please enter 'ductile' or 'brittle'.");
%     return;
% end

% Convert MRR matrix into a table format
mrr_table = array2table(mrr, 'VariableNames', compose("ma=%.3fkg/s", ma), 'RowNames',
compose("V=%.1fm/s", V));

% Display the table in the command window
disp("Material Removal Rate (MRR) Table:");
disp(mrr_table);

% Plot MRR vs Velocity for different mass flow rates
figure;
hold on;
for i = 1:length(ma)
    plot(V, mrr(:, i), 'o-', 'DisplayName', sprintf('ma = %.3f kg/s', ma(i)));
end
hold off;
xlabel('Velocity (m/s)');
ylabel('Material Removal Rate (MRR)');
title('MRR vs Velocity');
legend;
grid on;

% Plot MRR vs Mass Flow Rate for different velocities
figure;
hold on;
for i = 1:length(V)
    plot(ma, mrr(i, :), 's-', 'DisplayName', sprintf('V = %.1f m/s', V(i)));
end
hold off;
xlabel('Mass Flow Rate (kg/s)');
ylabel('Material Removal Rate (MRR)');
title('MRR vs Mass Flow Rate');
legend;
grid on;
```

Output:

```
Enter material type (ductile/brittle): ductile

Enter set of velocities [ ] in m/s: [100 300 600 900 1200 1800]

Enter set of mass flow rates [ ] in gm/s: [3 6 9 12 15 18]

Material Removal Rate (MRR) Table:
```

	ma=0.003kg/s	ma=0.006kg/s	ma=0.009kg/s	ma=0.012kg/s	ma=0.015kg/s	ma=0.018kg/s
V=100.0m/s	2.1429e-08	4.2857e-08	6.4286e-08	8.5714e-08	1.0714e-07	1.2857e-07
V=300.0m/s	1.9286e-07	3.8571e-07	5.7857e-07	7.7143e-07	9.6429e-07	1.1571e-06
V=600.0m/s	7.7143e-07	1.5429e-06	2.3143e-06	3.0857e-06	3.8571e-06	4.6286e-06
V=900.0m/s	1.7357e-06	3.4714e-06	5.2071e-06	6.9429e-06	8.6786e-06	1.0414e-05
V=1200.0m/s	3.0857e-06	6.1714e-06	9.2571e-06	1.2343e-05	1.5429e-05	1.8514e-05
V=1800.0m/s	6.9429e-06	1.3886e-05	2.0829e-05	2.7771e-05	3.4714e-05	4.1657e-05

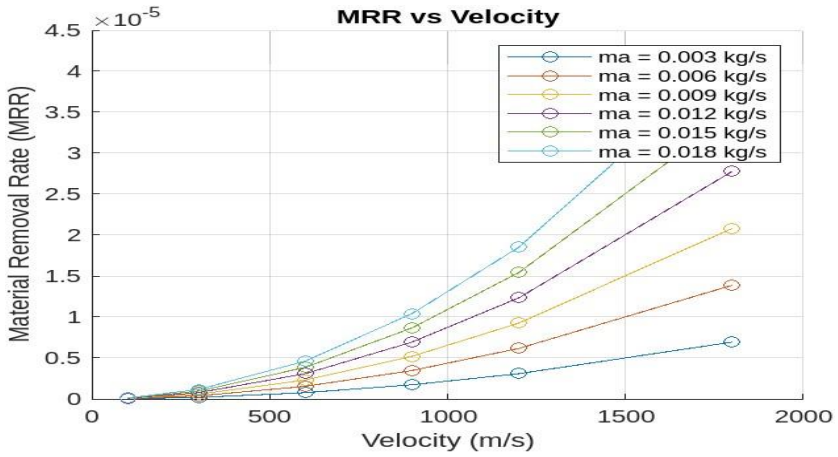

Fig 1:MRR vs velocity For Ductile

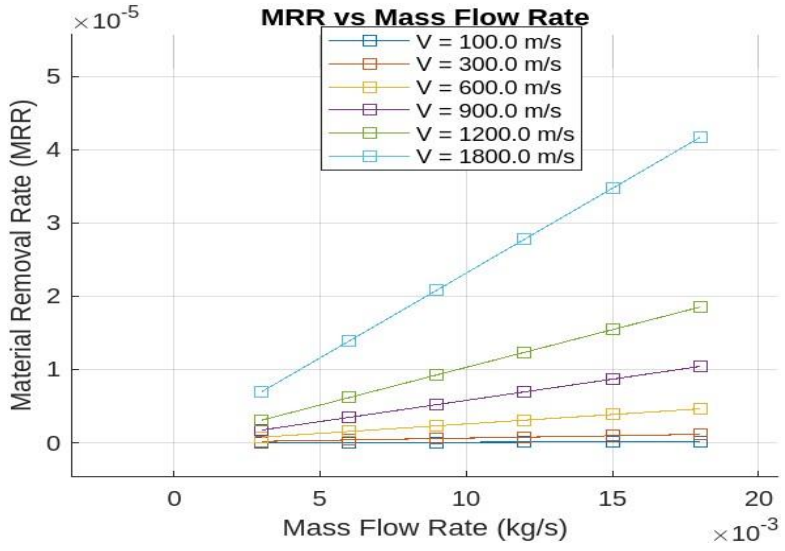

Fig 2:MRR Vs Mass Flow Rate

Enter material type (ductile/brittle): brittle

Enter set of velocities [ ] in m/s: [100 300 600 900 1200 1800]

Enter set of mass flow rates [ ] in gm/s: [3 6 9 12 15 18]

Material Removal Rate (MRR) Table:

	ma=0.003kg/s	ma=0.006kg/s	ma=0.009kg/s	ma=0.012kg/s	ma=0.015kg/s	ma=0.018kg/s
V=100.0m/s	9.3261e-08	1.8652e-07	2.7978e-07	3.7304e-07	4.663e-07	5.5956e-07
V=300.0m/s	4.846e-07	9.6919e-07	1.4538e-06	1.9384e-06	2.423e-06	2.9076e-06
V=600.0m/s	1.3706e-06	2.7413e-06	4.1119e-06	5.4826e-06	6.8532e-06	8.2239e-06
V=900.0m/s	2.518e-06	5.0361e-06	7.5541e-06	1.0072e-05	1.259e-05	1.5108e-05
V=1200.0m/s	3.8768e-06	7.7535e-06	1.163e-05	1.5507e-05	1.9384e-05	2.3261e-05
V=1800.0m/s	7.1221e-06	1.4244e-05	2.1366e-05	2.8488e-05	3.561e-05	4.2733e-05

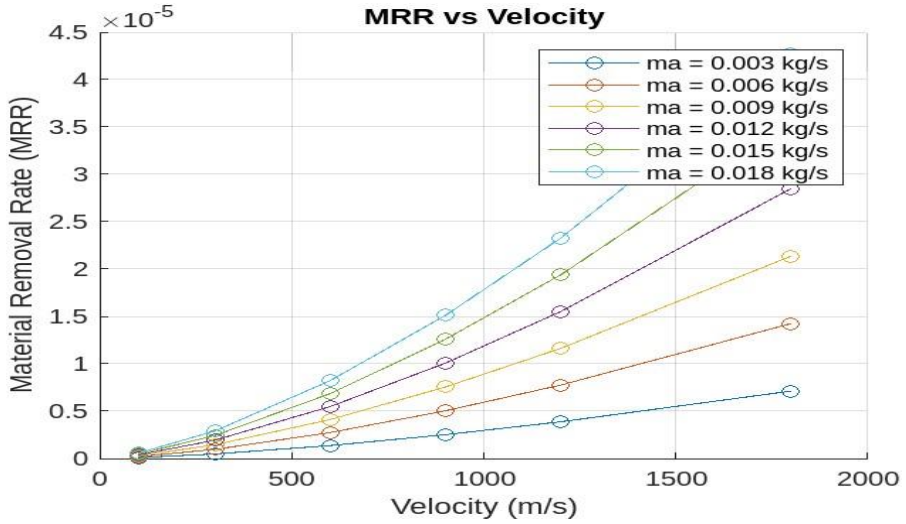

Fig 4:MRR Vs Velocity For Brittle

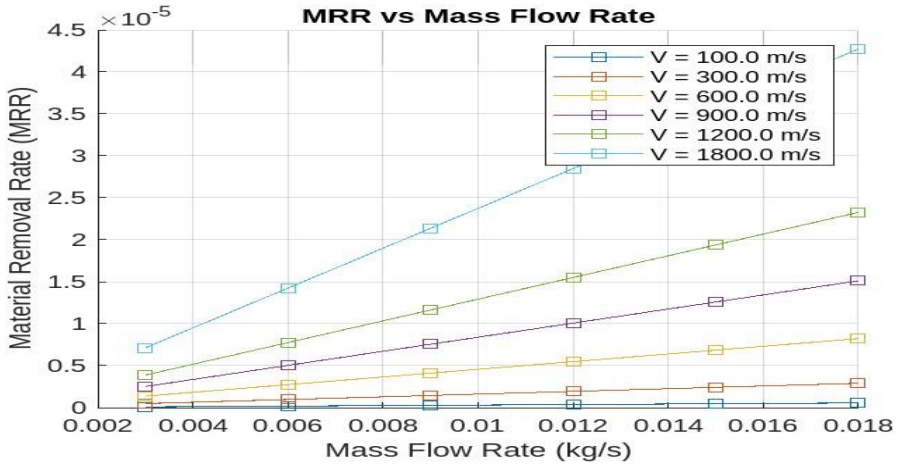

Fig 5:MRR Vs Mass Flow Rate For Brittle